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BASIC AND TRANSLATIONAL RESEARCH

Sex differences in auditory function and behavioral responses across age in the DBA2 mice model

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Objectives

The objective of this study is to investigate sex-specific differences in auditory function across the aging process in DBA2 mice, a model commonly used to study age-related hearing loss (ARHL). This study also aims to explore sex-based differences in cognitive performance and balance function, which may be influenced by hearing loss.

Methods

22 DBA2 mice (11 females, 11 males) underwent monthly assessments, including auditory function and behavioral responses, from 3 to 31 weeks of age. Auditory brainstem response (ABR) thresholds were measured at 8kHz, 16kHz, and 32kHz to evaluate hearing. Behavioral tests included the Y-maze test, which measured total arm entries to reflect activity levels and spontaneous alternation percentage as an indicator of spatial memory, and the Rota Rod test, which assessed motor coordination and postural stability by measuring the time to fall from an accelerating rotating rod.

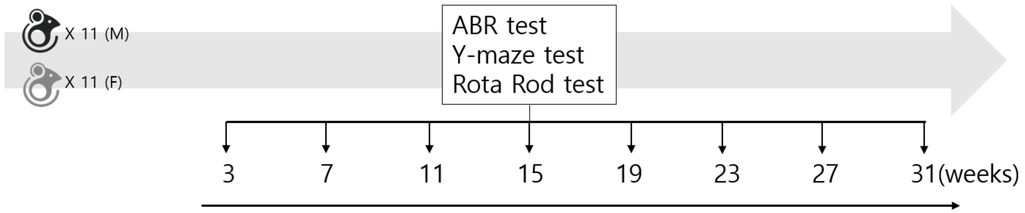

Fig. 1 Study design

Results

The average ABR threshold for each frequency increased over time, with males showing a more rapid increase than females at all frequencies (8, 16, and 32kHz). At 8kHz, neither males nor females reached a plateau within the study period, while at 16kHz, males reached a plateau of about 90dB after 15 weeks, and females reached the same level after 27 weeks. Similarly, at 32kHz, males reached the plateau after 15 weeks, and females after 23 weeks. Across all frequencies, the ABR threshold in male mice tended to increase 6 to 12 weeks faster than in female mice. Despite these differences in ABR thresholds, data collected up to 31 weeks of age revealed no significant differences between males and females in the Y-maze and Rota Rod tests.

The data are presented as means with standard deviations. Statistical significance is indicated as follows: * p<0.05, ** p<0.01, *** p<0.001, and **** p<0.0001, based on the Mann-Whitney test.

Results

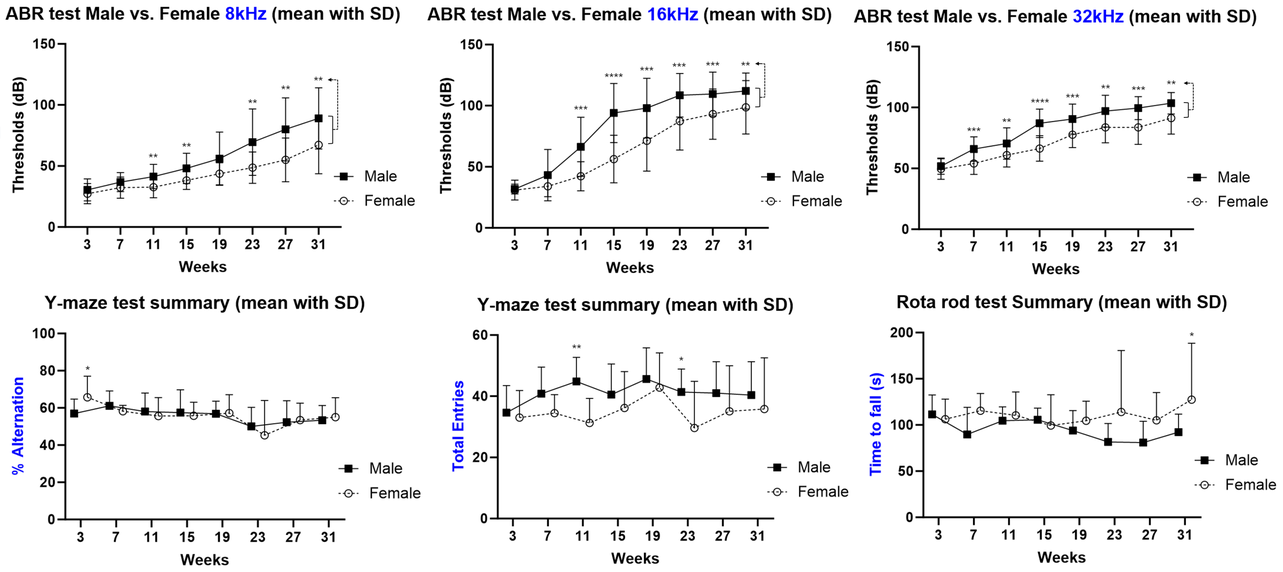

Fig. 2 Summary of monthly auditory and behavioral assessments across the aging process in DBA2 mice

Conclusion

Our study confirms that age-related hearing decline occurs more rapidly and severely in male DBA2 mice compared to females. While male mice are typically used to avoid hormonal cycle effects, sex-based differences in the auditory system necessitate the inclusion of female mice in future animal studies on this topic, which is crucial for comprehensive understanding of ARHL. Further exploration of these sex differences may contribute to the development of sex-tailored interventions for managing ARHL in humans. In contrast to the pronounced sex differences observed in hearing decline over time, the differences in cognitive and balance functions between sexes were not as evident.

References

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